DECLARATION

I, the undersigned, Naoko TANABIKI of c/o ARCO PATENT OFFICE at 3rd Fl., Bo-eki Building, 123-1 Higashi-machi, Chuo-ku, Kobe-shi 650-0031 JAPAN, hereby declare that I am conversant with Japanese and English languages and that attached is, to the best of my knowledge and belief, a true translation of the Japanese Patent Application No. 2001-391439 filed on December 25, 2001.

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Naoko Tanabiki

Naoko TANABIKI

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【Inventor】
【Domicile or Residence】 c/o MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
1006, Oaza-Kadoma, Kadoma-shi, Osaka, JAPAN
【Name】 Toshio AMAYA

【Applicant for Patent】
【Identification Number】 000005821
【Name or Designation】 MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.

【Agent】
【Identification Number】 100097445
【Patent Attorney】
【Name or Designation】 Fumio IWAHASHI

【Selected Agent】
【Identification Number】 100103355
【Patent Attorney】
【Name or Designation】 Tomoyasu SAKAGUCHI

【Selected Agent】
【Identification Number】 100109667
【Patent Attorney】
【Name or Designation】 Hiroki NAITOH

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[Name of document] Specification

[Title of the invention] Lighting unit and liquid crystal display device using the same

[Claims]

1. A lighting unit including a light source; a light guiding plate that guides light from the light source; a reflection sheet disposed in such a fashion so as to cover an underside of the light guiding plate; a housing that is provided to be spaced apart to surround the reflection sheet and has a predetermined thickness to hold the light source, the light guiding plate, and the reflection sheet, a rear face cover that is disposed under the light guiding plate to shield the light guiding plate from outside and is sized to surround outside of the housing, in which a region located above the light guiding plate is a display area, characterized in that a shield plate having heat conductivity higher than that of air and having sides larger 1mm than an outer periphery of an inner wall of the housing and smaller than an outer periphery of an outer wall is disposed between the reflection sheet and the rear face cover to cover an entire of the light guiding plate.

2. A liquid crystal display device characterized by comprising a lighting unit as recited in claim 1 and a liquid crystal panel disposed on a light emission face side of the lighting unit.

[Detailed description of the invention]

[0001]

[Technical field of the invention]

The present invention relates to a lighting unit having a light source provided at a facet of a light guiding plate and a liquid crystal display device using the same.

[0002]

[Background art]

In recent years, liquid crystal display devices have frequently been used as display devices of information appliances such as a notebook type personal computer and a word processor and display devices of imaging appliances such as a mobile television, a portable motion picture camera, and a car navigation system owing to its

characteristics such as light weight, thin thickness, and low power consumption. In the liquid crystal display devices, generally, a display panel is illuminated with light which is emitted from the rear by an internal lighting unit so as to realize a luminous display screen.

[0003]

An edge light type lighting unit wherein a light guiding plate is disposed on the rear face of the display panel and a linear light source such as a fluorescent discharge tube is provided at a facet of the light guiding plate is ordinarily used as a backlight of the liquid crystal display device included in the notebook type personal computer and so forth owing to its characteristics of thin thickness and excellent uniformity in luminance on a light emission face.

[0004]

Figs. 4 and 5 show a conventional edge light type lighting unit UT using fluorescent discharge tubes, and a liquid crystal display device LD having the lighting unit UT. The lighting unit UT has a tabular transparent light guiding plate 1 for transmitting light, fluorescent discharge tubes 2 disposed at two opposing sides of four sides of the light guiding plate 1, and a reflection sheet 3 for reflecting light emitted from the fluorescent discharge tubes 2 to guide the reflected light to facets D1 of the light guiding plate 1. The light guiding plate 1, the fluorescent discharge tubes 2, and the like are held by a rear face cover 8 and a housing 9, thereby forming a lighting unit. A lighting unit UT thus structured is stored into a space formed by combining the rear face cover 8 on a lower side with a predetermined shape and the housing 9 on an upper side, and a liquid crystal panel 11 and a front cover 12 are mounted on the lighting unit UT. Thus, the liquid crystal display device LD is obtained.

[0005] The reflection sheet 3 reflects light leaking from the light guiding plate 1 to the outside to return the leaked light to the light guiding plate 1, thereby increasing illumination light to be emitted from the light emission face. A white resin film having a high reflectance is used as the reflection sheet 3. Patterns which make a light diffusion area increased in proportion to distance from the fluorescent discharge tubes 2 may be printed on the reflection sheet 3. As shown in Fig. 3, the reflection

sheet 3 is cut to a predetermined shape, and is provided with perforations S on predetermined positions.

[0006]

As the reflection sheet 3, a region around the fluorescent discharge tube 2 (this region is in some cases called "reflector") and a region on a rear surface side of the light guiding plate 1 may be separably bonded to by an adhesive double coated tape. But, an integral structure illustrated in Fig. 4 advantageously makes the lighting unit UT thinner and reduces cost and the number of assembly steps.

[0007] Light correction sheets 4 and 5 are provided on the light emission face side of the light guiding plate. The light correction sheets 4 and 5 are diffusion sheets, prism sheets and the like. The light emitted from the light guiding plate 1 can be diffused or the like by selecting a sheet to be used for the light correction sheets 4 and 5 among a various types of sheets and by setting the number of sheets as required, thereby achieving uniformity and high luminance of the emitted light.

[0008]

Each of ends of the fluorescent discharge tubes 2 is connected to lead wires by soldering or the like, and the lead wires are connected to a power unit such as an inverter for generating a high frequency alternating current. A voltage required for lighting the fluorescent discharge tubes 2 is applied from the power unit. Generally, a high voltage is required for lighting the fluorescent discharge tubes 2. Accordingly, a rubber holder 7 made from an insulator such as a rubber is attached to each of the fluorescent discharge tubes 2 and around the lead wires so as to protect electrodes of the fluorescent discharge tubes 2 and ensure safety of the lead wires by covering exposed portions thereof.

[0009]

Heat discharge holes for discharging heat generated from the fluorescent discharge tubes are formed on rear face cover 8, although they are not shown. Also, there is a gap between the rear face cover 8 and the housing 9.

[0010]

[Problems to the solved by the invention]

In the conventional lighting unit UT and the liquid crystal display device LD of the above constitution, through the heat discharge holes of the rear face cover 8 or gaps formed between the rear face cover 8 and the housing 9 fitted with each other, dust generated during assembly or the like of the liquid crystal display device LD enters a display area formed of the liquid crystal panel 11 and the light correction sheets 4 and 5. The dust entered the display area interrupts the output light to cause irregular luminance. Further, the components in the display area such as the light correction sheets 4 and 5 are damaged due to friction between the light correction sheets 4 and 5 and the dust. Moreover, when the dust enters a gap between the liquid crystal panel 11 and the lighting unit UT, it is very difficult to remove the dust without disassembling the display device.

[0011]

Further, regarding heat discharge, the gap between the rear face cover 8 and the housing 9 functions as a heat insulation layer to cause insufficient heat discharge.

[0012]

Accordingly, an object of the present invention is to provide a lighting unit capable of preventing dust from entering a display area without fail and a liquid crystal display device using the same.

[0013]

[Means for solving the problem]

A lighting unit of the present invention including a light source; a light guiding plate that guides light from the light source; a reflection sheet disposed in such a fashion so as to cover an underside of the light guiding plate; a housing that is provided to be spaced apart to surround the reflection sheet and has a predetermined thickness to hold the light source, the light guiding plate, and the reflection sheet, a rear face cover that is disposed under the light guiding plate to shield the light guiding plate from outside and is sized to surround outside of the housing, in which a region located above the light guiding plate is a display area, is characterized in that a shield plate having heat conductivity higher than that of air and having sides larger 1mm than an outer periphery of an inner wall of the housing and smaller than an outer periphery of

an outer wall is disposed between the reflection sheet and the rear face cover to cover an entire of the light guiding plate.

[0014] In accordance with this invention, in the lighting unit UT and the liquid crystal display device LD, it is possible to prevent entry of dust into a display area formed of the liquid crystal panel 11 and the light correction sheets 4, through the heat discharge holes of the rear face cover 8 or gaps formed between the rear face cover 8 and the housing 9 fitted with each other. In addition, heat radiation ability is improved.

[0015] A liquid crystal display device as recited in claim 2 is characterized by comprising a lighting unit as recited in claim 1 and a liquid crystal panel disposed on a light emission face side of the lighting unit.

[0016] In accordance with the invention as recited in claim 2, dust is prevented from entering the display area in which the liquid crystal display panel is disposed, from inside of the housing or outside. Further, thanks to the improved heat discharge property, various defects otherwise caused by heat generated are suppressed.

[0017]

[Embodiments of the invention]

Hereinafter, an embodiment of the present invention will be described with reference to the drawings.

[0018]

As shown in Fig. 1, the lighting unit UT of this embodiment is provided with: light sources 2; a tabular light guiding plate 1 for transferring light from the light sources 2, a reflection sheet 3 disposed in such a fashion as to cover an underside of the light guiding plate 1; a housing 9 provided to be spaced apart so as to surround the reflection sheet 3, and a rear surface cover 8. The lighting unit UT is stored into the box-like housing 9 after the light guiding plate 1, the reflection sheet 3 and the fluorescent discharge tubes 2 are assembled, these components 1, 2, and 3 are held. The housing 9 of this embodiment serves to hold the light guiding plate 1 from outer peripheral side and from below. Further, the housing 9 and the housing 10 fitted from above are assembled, thus completing the lighting unit UT. The housings 9 and 10

are various housings such as box-like housing made from resin material, a housing formed of combination thereof, or a housing holding the liquid crystal panel 11 disposed above the light guiding plate 1. As shown in Fig. 2, the liquid crystal panel 11 is mounted on the lighting unit UT, and the front cover 12 is mounted thereon, thereby completing the liquid crystal display device LD. The front cover 12 is one type of housing.

[0019]

The light guiding plate 1 is made from a material such as acryl having transmissivity, a refractive index, and like optical characteristics which are optimum for light transmission. On the rear face of the light guiding plate 1, a dot pattern or a groove pattern or the like(not shown), a shape of which is changed depending on distances from the fluorescent discharge tubes 2, is formed. Light correction sheets 4 and 5 provided on a front face side achieves uniformity and high luminance of the light emitted from the lighting unit UT. The light emitted from the light fluorescent discharge tubes 2 is gathered to an incident facet D1 of the light guiding plate 1 and is guided to the inside.

[0020] A white resin film having a high reflectance is used as the reflection sheet 3. The reflection sheet 3 is bent in U-shape in cross-section from rear. To be specific, one side of the reflection sheet 3 is bent to surround the fluorescent light discharge tubes 2 and is fixed to a surface of the light guiding plate 1 with an adhesive double coated tape. A side E2 on which the fluorescent light discharge tube 2 is not disposed is bent to conform to an opposing facet D2 of the light guiding plate 1 which is opposite to the incident facet D1. Thereby, the light emitted from the opposing facet D2 is returned into the light guiding plate 1 again so that light emitted from the surface of the light guiding plate 1 is increased. The reflection sheet 3 on the rear surface of the light guiding plate 1 serves to return the light emitted from the rear surface of the light guiding plate 1 into the light guiding plate 1 again to increase the illuminated light emitted. As the reflection sheet 3, there is a reflection sheet in which a region around the fluorescent light discharge tube 2 (this region is sometimes called reflector) and a region under the light guiding plate 1 are separated, in addition to the above mentioned

integral structure. The present invention is applicable to the reflection sheet 3 having such a structure.

[0021] Light correction sheets 4 and 5 are disposed on the light emission face side of the light guiding plate 1. The light correction sheets 4 and 5 serve to achieve uniformity and high luminance of the light emitted from the lighting unit UL. A diffusion sheet 4 and a prism sheet 5 are used therefor. The diffusion sheet 4 is a sheet-like optical member used for diffusing light from the fluorescent discharge tubes 2 to irradiate the liquid crystal panel 11 uniformly with the diffused light. The prism sheet 5 is a transparent resin film having triangular regular grooves. The light correction sheets 4 and 5 are not intended to be limited to the diffusion sheet 3 or the prism sheet 5, and it is possible to use various sheets varied in optical characteristics as the light correction sheet. The present invention is applicable without limiting specification and number. The light correction sheets 4 and 5 of this embodiment are not bonded to the light guiding plate 1, the reflection sheet 3, the housing 9 and the like.

[0022]

Conventionally, after the completion of the liquid crystal display LD, it was impossible to prevent entry of the dust from outside or inside of the housing 9 or the like into the display area. In addition, once the dust entered a region between the liquid crystal panel 11 and the lighting unit UT, it was impossible to remove the dust without disassembling the liquid crystal display device LD. Thus, a precaution against the dust entrance is an important issue in maintenance of the liquid crystal display device LD after the assembly.

[0023]

In accordance with the lighting unit UT and the liquid crystal display device LD of this embodiment of the present invention, a shield plate 13 is inserted for isolation between the reflection sheet 3 and the rear face cover 8, thereby enabling isolation from the display area. So, it is possible to prevent entry of dust. Although the gap between the rear face cover 8 and the housing 9 fitted with each other serves as a heat insulating layer, the shield plate 13 made of metal such as aluminum and having high heat conductivity is inserted there, thereby improving heat radiation.

[0024] Thus far, while in the above mentioned embodiments, the present invention is applicable to the lighting unit using two fluorescent light discharge tubes, it is applied to various lighting units.

[0025]

[Effects of the invention]

As described above, according to the lighting unit and the liquid crystal display device of the present invention, dust is prevented from entering the display area of the liquid crystal display device without fail, thereby eliminating non uniform luminance otherwise caused by the dust entrance and preventing damages on the components in the display area otherwise caused by the dust. Further, thanks to the improved heat discharge property, various defects otherwise caused by heat generated during operation are suppressed.

[Brief Description of the drawings]

Fig. 1 is a sectional view showing a constitution of a lighting unit according to an embodiment of the present invention.

Fig. 2 is a sectional view showing a constitution of a liquid crystal display device having the lighting unit of the embodiment.

Fig. 3 is a schematic development showing a structure of a reflection sheet used in the lighting unit.

Fig. 4 is a plan view showing a constitution of the conventional lighting unit.

Fig. 5 is a cross-sectional view showing a constitution of the conventional lighting unit.

[Explanation of reference numerals]

1	light guiding plate
2	fluorescent light discharge tube (light source)
3	reflection sheet
4, 5	light correction sheet
6	adhesive double-coated tape
7	rubber holder
8	rear face cover

9, 10	housing
11	liquid crystal panel
12	front cover
13	shield plate
D1	incident facet of light guiding plate
D2	opposing facet of light guiding plate opposite to the incident facet
E2	side on which light source is not disposed
UT	lighting unit
LT	liquid crystal display device

[Name of document] abstract

[Summary]

[Objective] A lighting unit capable of preventing entry of dust into a display area without fail and a liquid crystal display device using the same are provided.

[Solving means] A lighting unit including a light source 2; a light guiding plate 1 that guides light from the light source 2; a reflection sheet 3 disposed in such a fashion so as to cover an underside of the light guiding plate 1; a housing 9 that is provided to be spaced apart to surround the reflection sheet 3 and has a predetermined thickness to hold the light source 2, the light guiding plate 1, and the reflection sheet 3, a rear face cover 8 that is disposed under the light guiding plate 1 to shield the light guiding plate 1 from outside and is sized to surround outside of the housing 9, in which a region located above the light guiding plate 1 is a display area, is characterized in that a shield plate 13 having heat conductivity higher than that of air and having sides larger 1mm than an outer periphery of an inner wall of the housing 9 and smaller than an outer periphery of an outer wall is disposed between the reflection sheet 3 and the rear face cover 8 to cover an entire of the light guiding plate 1.

[Selected drawing] Fig. 1

[Name of Document] Drawings

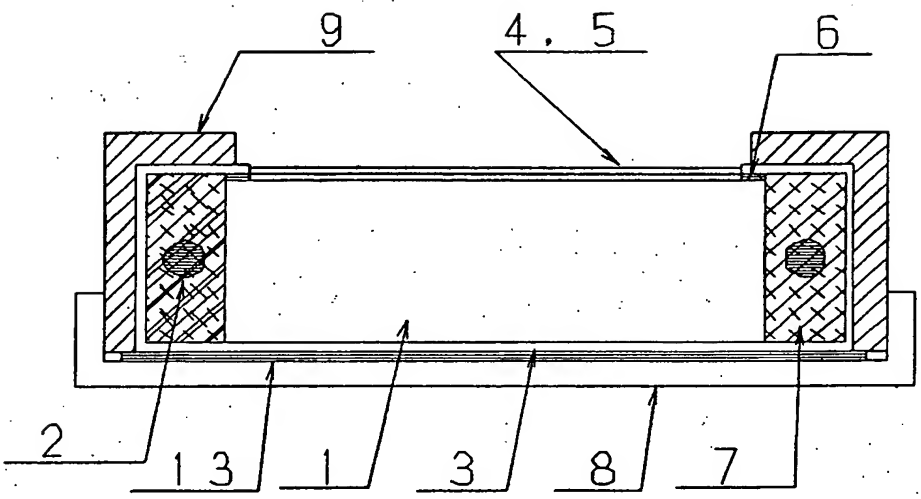

FIG. 1

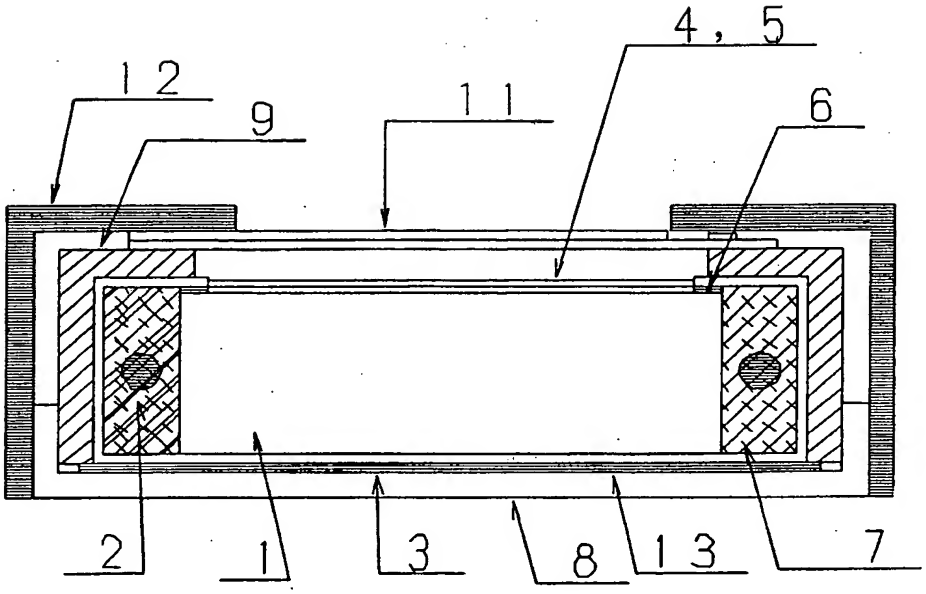

FIG. 2

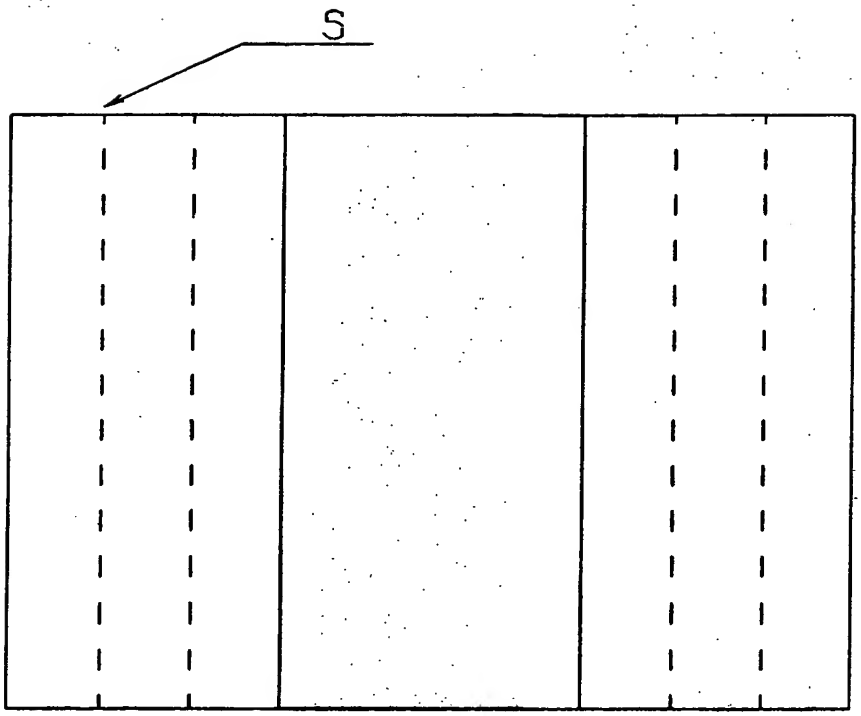

FIG. 3

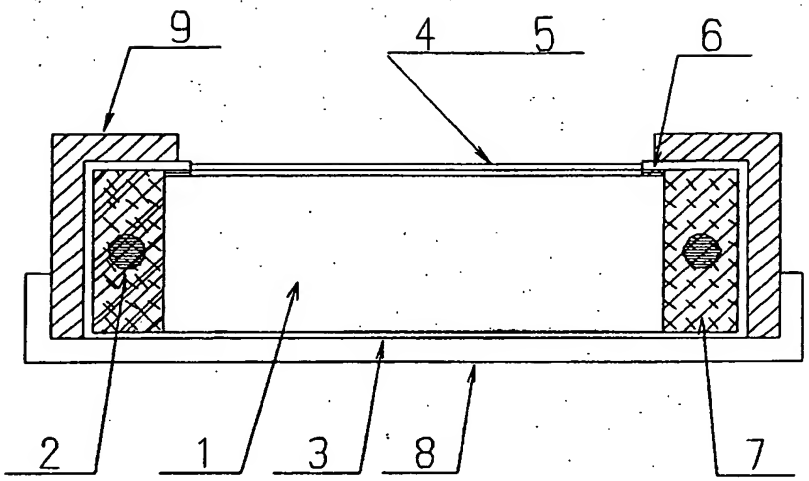

FIG. 4

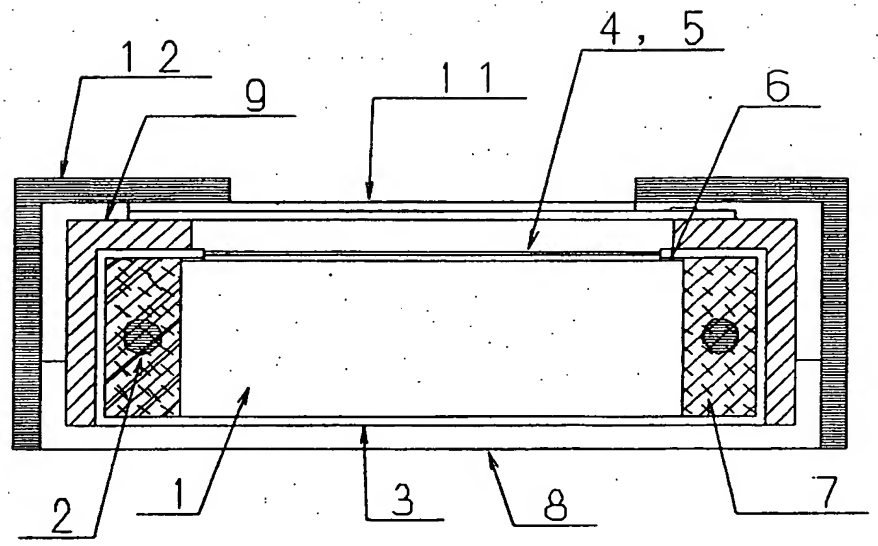

FIG. 5